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Amendments to the Claims

Following is a complete set of claims as amended with this Response. This complete set of claims includes amended claims 1 and 11.

1. (Currently Amended) In an implantable defibrillator, a shocking circuit comprising:

a set of capacitors; and

switching circuitry connected to the capacitors and operative to selectively discharge the capacitors so as to generate a first phase of a biphasic defibrillation pulse waveform wherein the first phase of the waveform has at least three distinct voltage peaks.

2. (Previously Presented) The implantable defibrillator of Claim 1, wherein the set of capacitors comprises first, second and third capacitors.

3. (Previously Presented) The implantable defibrillator of Claim 2, wherein the switching circuitry is operative to:

generate a first step of the pulse waveform by discharging the capacitors while the first, second and third capacitors are connected in parallel;

generate a second step of the pulse waveform by discharging the capacitors while the first and second capacitors are connected in parallel and the third capacitor is connected in series; and

generate a third step of the pulse waveform by discharging the capacitors while the first, second and third capacitors are connected in series.

4. (Previously Presented) The implantable defibrillator of Claim 3, wherein the switching circuitry is operative to selectively discharge the capacitors during the three steps of the pulse waveform for respective first, second and third time periods selected to maximize a final myocardial voltage within myocardial tissue receiving the pulse waveform.

5. (Previously Presented) The implantable defibrillator of Claim 4, wherein the first, second and third time periods are represented, respectively, by:

$$d_1^{opt} = -\frac{\tau_m}{\alpha_1}\cdot\ln\left\{\left(\frac{\tau_m}{\tau_{s1}}\right)\left(\frac{2-\frac{\alpha_2}{\alpha_1}}{1-\frac{\alpha_2}{\alpha_1}}\right)\right\};$$

$$d_2^{opt} = +\frac{\tau_m}{\alpha_2}\cdot\ln\left\{\left(\frac{1}{2}\right)\left(\frac{2-\frac{\alpha_2}{\alpha_1}}{1-\frac{\alpha_2}{\alpha_1}}\right)\left(\frac{1-\frac{\alpha_3}{\alpha_2}}{K_C-\frac{\alpha_3}{\alpha_2}}\right)\right\};\text{ and}$$

$$d_3^{opt} = -\frac{\tau_m}{\alpha_3}\cdot\ln\left\{\left(K_C\right)\left(\frac{1-\frac{\alpha_3}{\alpha_2}}{K_C-\frac{\alpha_3}{\alpha_2}}\right)\right\};\text{ wherein}$$

$$K_C = 1+(C_C)/(C_A+C_B+C_C);$$

$$\alpha_1 = 1-(\tau_m/\tau_{s1}),\ \alpha_2 = 1-(\tau_m/\tau_{s2}),\text{ and }\alpha_3 = 1-(\tau_m/\tau_{s3});$$

$$\tau_{s1} = R_s\cdot C_{s1};\ \tau_{s2} = R_s\cdot C_{s2};\text{ and }\tau_{s3} = R_s\cdot C_{s3};$$

$$C_{s1} = C_A+C_B+C_C;$$

$$C_{s2} = [(C_A+C_B)\cdot(C_C)]/[C_A+C_B+C_C];$$

$$C_{s3} = 1/\left[\frac{1}{C_A}+\frac{1}{C_B}+\frac{1}{C_C}\right];$$

C_A, C_B, & C_C are the respective capacitances of the first, second and third capacitors; and

τ_m is a predetermined myocardial tissue time constant.

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6. (Previously Pr sented) The implantable defibrillator of Claim 2, wherein the capacitance of the capacitors are selected so as to minimize th amount of energy to be stored in the capacitors while maximizing a final myocardial voltage within myocardial tissue receiving the pulse waveform.

7. (Previously Presented) The implantable defibrillator of Claim 6, wherein capacitances of the first, second and third capacitors are represented, respectively, by:

$$C_A^{opt} = 0.6673 \cdot \left(\frac{\tau_m}{R_s}\right);$$

$$C_B^{opt} = 0.6673 \cdot \left(\frac{\tau_m}{R_s}\right); \text{ and}$$

$$C_C^{opt} = 1.5356 \cdot \left(\frac{\tau_m}{R_s}\right); \text{ wherein}$$

R_s is a predetermined system resistance; and

τ_m is a predetermined myocardial tissue time constant.

8. (Previously Presented) The implantable defibrillator of Claim 6, wherein the capacitances of the first, second and third capacitors are represented, approximately, by:

$$C_A^{opt} = \left(\frac{2}{3}\right) \cdot \left(\frac{\tau_m}{R_s}\right);$$

$$C_B^{opt} = \left(\frac{2}{3}\right) \cdot \left(\frac{\tau_m}{R_s}\right); \text{ and}$$

$$C_C^{opt} = \left(\frac{3}{2}\right) \cdot \left(\frac{\tau_m}{R_s}\right).$$

9. (Previously Presented) The implantable defibrillator of Claim 6, wherein the switching circuitry is operative to selectively discharge the capacitors during the three steps of the pulse waveform for respective first, second and third time periods.

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10. (Previously Presented) Th implantabl defibrillator of Claim 9, wherein the first, second and third time periods are represented, respectively, by:

$d_1^{opt} = 0.878 \cdot \tau_m$;

$d_2^{opt} = 0.277 \cdot \tau_m$;and

$d_3^{opt} = 0.200 \cdot \tau_m$; wherein

τ_m is a predetermined myocardial tissue time constant.

11. (Currently Amended) In an implantable defibrillator having a set of capacitors, a method for generating a shocking pulse comprising the steps of:

charging the capacitors; and

selectively discharging the capacitors so as to generate a first phase of a biphasic defibrillation pulse waveform wherein the first phase of the waveform has at least three distinct voltage peaks.

12. (Original) The method of Claim 11 for use in a shocking circuit having first, second, and third capacitors and wherein the step of selectively discharging the capacitors includes the steps of:

generating a first step of the pulse waveform by discharging the capacitors while the first, second and third capacitors are connected in parallel;

generating a second step of the pulse waveform by discharging the capacitors while the first and second capacitors are connected in parallel and the third capacitor is connected in series; and

generating a third step of the pulse waveform by discharging the capacitors while the first, second and third capacitors are connected in series.

13. (Original) The method of Claim 12, wherein the steps of discharging the capacitors to generate the first, second and thirds steps of the pulse waveform are respectively performed for first, second and third time periods selected to maximize a final myocardial voltage within myocardial tissue receiving the pulse waveform.

14. (Original) The method of Claim 13, wherein the first, second and third time periods are represented, respectively, by:

$$d_1^{opt} = -\frac{\tau_m}{\alpha_1}\cdot\ln\left\{\left(\frac{\tau_m}{\tau_{s1}}\right)\left(\frac{2-\frac{\alpha_2}{\alpha_1}}{1-\frac{\alpha_2}{\alpha_1}}\right)\right\};$$

$$d_2^{opt} = +\frac{\tau_m}{\alpha_2}\cdot\ln\left\{\left(\frac{1}{2}\right)\left(\frac{2-\frac{\alpha_2}{\alpha_1}}{1-\frac{\alpha_2}{\alpha_1}}\right)\left(\frac{1-\frac{\alpha_3}{\alpha_2}}{K_C-\frac{\alpha_3}{\alpha_2}}\right)\right\}; \text{ and}$$

$$d_3^{opt} = -\frac{\tau_m}{\alpha_3}\cdot\ln\left\{(K_C)\left(\frac{1-\frac{\alpha_3}{\alpha_2}}{K_C-\frac{\alpha_3}{\alpha_2}}\right)\right\}; \text{ wherein}$$

$$K_C = 1+(C_C)/(C_A+C_B+C_C);$$

$$\alpha_1 = 1-(\tau_m/\tau_{s1}),\ \alpha_2 = 1-(\tau_m/\tau_{s2}), \text{ and } \alpha_3 = 1-(\tau_m/\tau_{s3});$$

$$\tau_{s1} = R_s\cdot C_{s1};\ \tau_{s2} = R_s\cdot C_{s2}; \text{ and } \tau_{s3} = R_s\cdot C_{s3};$$

$$C_{s1} = C_A+C_B+C_C;$$

$$C_{s2} = [(C_A+C_B)\cdot(C_C)]/[C_A+C_B+C_C];$$

$$C_{s3} = 1/\left[\frac{1}{C_A}+\frac{1}{C_B}+\frac{1}{C_C}\right];$$

C_A, C_B, & C_C are the respective capacitances of the first, second and third capacitors; and

τ_m is a predetermined myocardial tissue time constant.

15. (Original) The method of Claim 12 further including the initial step of selecting optimal capacitances for the capacitors so as to minimize the amount of energy to be stored in the capacitors while maximizing a final myocardial voltage within myocardial tissue receiving the pulse waveform.

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16. (Previously Presented) Th method of Claim 15, wherein the optimal capacitances of the first, second and third capacitors are represented, resp ctively, by:

$$C_A^{opt} = 0.6673 \cdot \left(\frac{\tau_m}{R_s}\right);$$

$$C_B^{opt} = 0.6673 \cdot \left(\frac{\tau_m}{R_s}\right); \text{ and}$$

$$C_C^{opt} = 1.5356 \cdot \left(\frac{\tau_m}{R_s}\right); \text{ wherein}$$

R_s is a predetermined system resistance; and

τ_m is a predetermined myocardial tissue time constant.

17. (Cancelled)

18. (Original) The method of Claim 15 further including the step of selectively discharging the capacitors during the three steps of the pulse waveform for respective first, second and third time periods.

19. (Original) The method of Claim 18, wherein the first, second and third time periods are represented, respectively, by:

$$d_1^{opt} = 0.878 \cdot \tau_m;$$

$$d_2^{opt} = 0.277 \cdot \tau_m; \text{and}$$

$$d_3^{opt} = 0.200 \cdot \tau_m; \text{ wherein}$$

τ_m is a predetermined myocardial tissue time constant.

20. (Original) In a defibrillator having first, s cond and third capacitors, a shocking circuit comprising:

means for charging the capacitors;

means for generating a first step of a first phase of a defibrillation pulse waveform by discharging the capacitors while the first, second and third capacitors are connected in parallel;

means for generating a second step of the first phase of the defibrillation pulse waveform by discharging the capacitors while the first and second capacitors are connected in parallel and the third capacitor is connected in series; and

means for generating a third step of the first phase of the defibrillation pulse waveform by discharging the capacitors while the first, second and third capacitors are connected in series.

21. (Original) The system of Claim 20, wherein the means for discharging the capacitors to generate the first, second and third steps of the pulse waveform respectively operate for first, second and third time periods selected to maximize a final myocardial voltage within myocardial tissue receiving the pulse waveform.